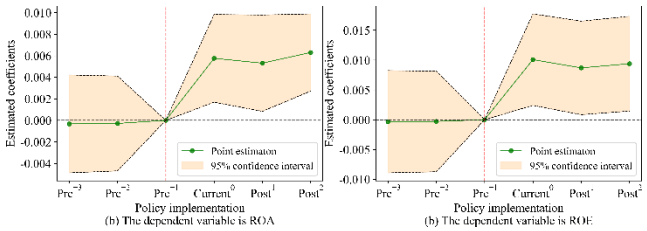
Global NEST Journal, Vol 26, No 3, 05750

The impact of environmental protection tax policy on the financial performance of heavy pollution enterprises

Xue Lei[1] and Kunjian Zhao[2]
[1]School of Management, Shanghai University, Shanghai 200444, China
[2]School of Management, Wuhan University of Technology, Wuhan 430070, China
Received: 20/01/2024, Accepted: 19/02/2024, Available online: 20/02/2024
*to whom all correspondence should be addressed: e-mail: zhaokunjian95@163.com
https://doi.org/10.30955/gnj.005750

Graphical abstract



Abstract

Leveraging the implementation of China's environmental protection tax (EPT) policy in 2018 as a focal point, this study employs a quasi-natural experiment via the double-difference method to investigate the EPT's impact on the financial performance (FP) of publicly listed companies in heavily polluting industries. The findings reveal the EPT's sustained and positive dynamic effect on the FP of these enterprises, a trend validated through parallel trend and placebo tests. Furthermore, the research highlights that non-state-owned and large-scale firms exhibit more substantial incentives for enhancing their FP.

Keywords: EPT, Heavy polluting enterprises, Balanced trend test, Placebo test

1. Introduction

Amidst the rapid expansion of the global economy, China has actively pursued globalization and industrialization (Wei & Liefner 2012; Zhang & Rasiah 2015). However, this swift economic growth has spurred a host of environmental challenges (Zeng *et al.* 2023). China has proactively implemented measures to address environmental issues accompanying its economic surge.

China has implemented the EPT policy since 2018, and its "double dividend" has gradually appeared (Huang & Li 2023). The collection of EPT has effectively curbed and reduced pollution emissions and improved the quality of the environment while at the same time reducing the negative impact of environmental policies on capital and labour output, thus improving the employment level of society and promoting sustainable economic growth (Li *et al.* 2023). The implementation of the EPT policy is not only to combat environmental pollution but also to promote the heavy pollution enterprises to improve the production situation, actively carry out technological innovation, and then enhance the FP of enterprises themselves to achieve long-term sustainable development (Lin *et al.* 2023).

In the face of the pressure brought about by the EPT, the affected heavily polluting enterprises have to carry out internal reforms to offset the negative impact of the environmental protection expenditure. In recent years, more and more enterprises have gradually adjusted their business structure as China has increased its environmental protection investment. However, scholars have yet to unanimously conclude the impact of EPT policies on the FP of heavily polluting firms. Therefore, this paper explores the potential impact of EPT policy on the FP of heavily polluting enterprises.

This study, centered on the implementation of China's environmental protection tax (EPT) policy in 2018, employs a quasi-natural experiment using the double-difference method to examine its impact on the financial performance (FP) of publicly listed companies in heavily polluting industries. The key marginal contribution of this research lies in uncovering the sustained and positive dynamic effect of the EPT on the FP of these enterprises, validated through balanced trend and placebo tests. Particularly noteworthy is the finding that non-state-owned and large-scale firms exhibit more significant incentives for enhancing their financial performance, contributing to the understanding of the nuanced impact of EPT policies on different types of enterprises.

2. Policy review and research assumption

2.1. Policy review

The implementation of China's EPT Law in 2018 signifies a significant advancement in its environmental governance. This legislation integrates the previous pollutant discharge fee system, employing a differentially structured taxation system to guide businesses towards sustainable, green development, yielding initial positive outcomes. Taxation data reveals variations in tax amounts across different industries, reflecting the differentials in taxation, a practice

consistent with international norms. However, for the EPT to achieve more effective environmental goals, it necessitates flexible tax reduction policies and enhanced regulatory enforcement. In summary, this law underscores China's leadership in global environmental governance, offering valuable insights for the international community.

2.2. Research assumption

China began to implement the EPT policy in early 2018, which imposes an EPT on pollutant emissions to meet the standards of pollutant emission limits (Gu & Wang 2023; Guo *et al.* 2023). The EPT has an uplifting effect on the environmental protection costs of heavily polluting enterprises, mainly in the following three aspects: first, the pressure of the EPT has prompted enterprises to seek new ways to improve their profitability to offset the cost of emissions (J. Hu *et al.* 2023; X. R. Hu *et al.* 2023; Jiang *et al.* 2023). As the EPT makes the sewage cost of some enterprises higher than the period of sewage charges, resulting in a decline in corporate income under the same conditions, in order to restore or improve the level of income, enterprises need to increase profitability and competitiveness by improving production efficiency or reducing unit costs, which is beneficial to the FP of enterprises in the long run (Kong *et al.* 2023; Lei *et al.* 2023; Liu 2023; Ma & Cui 2023; Rao *et al.* 2023). Second, the regulatory role of EPT incentivizes firms to innovate clean technologies or green products to reduce emissions costs and capture market opportunities (Su *et al.* 2023; Sun & Zhang 2023; Xu *et al.* 2023; Yan *et al.* 2023). Environmental protection costs make enterprises pay attention to clean technology and use new technology to reduce pollution emissions in the production process, thus reducing costs, which is favourable to FP; enterprises research and development and production of green products to meet consumer demand, which helps to seize market share and improve corporate profitability, which in turn has a positive impact on FP (Zhao *et al.* 2023). Thirdly, enterprises actively responding to the EPT policy can establish a good corporate image and gain more external support (Zheng *et al.* 2023; Zhou & Yang 2023). Enterprises that reduce pollution can enjoy more EPT concessions and alleviate the pressure of sewage; enterprises that reduce pollution by increasing investment in technological innovation can transmit good business signals to the outside world, attract more investors, and alleviate the pressure of external financing of the enterprise; in addition, a better business environment will also attract more workers, who can be hired at a lower cost, further reducing the cost of the enterprise, which also helps to improve the FP of more polluting enterprises (Yang & Peng 2021). According to "Strong Porter's Hypothesis," a reasonable EPT can encourage enterprises to actively carry out research and development of new technologies and products to make up for the cost of environmental regulation and generate additional benefits, it can enable heavy polluting enterprises to obtain compensation for innovation and first-mover advantage in the market (Guan *et al.* 2023), and ultimately enhance the FP of enterprises. Based on the above discussion, this paper puts forward the following hypotheses:

H1: EPT has a positive promotion effect on the FP of heavy pollution enterprises.

3. Research design

3.1. Model setting

In order to assess the impact of EPT on the FP of heavily polluting enterprises, the following double-difference model is established based on the previously proposed hypothesis:

$$ROA_{i,t} = \alpha_0 + \alpha_1 \mathrm{DID}_{i,t} + \alpha_2 \ \mathrm{Controls}_{i,t} + Year_i + \mathrm{Industry}_i + Company_i + + \varepsilon_{i,t} \quad (1)$$

As shown in Equation (1), ROA stands for Return on Assets, an essential indicator of a firm's FP. Post stands for whether the environmental protection tax has been implemented, and Treat indicates whether the firm is a severe polluter. DID is the primary explanatory variable in this paper, which is also the interaction term of Treat and Post. Control is the control variables: Size, Shc, Lev, CMIR, and ATO. Year, Industry, and Company represent individual dummy effects for year, industry, and firm, respectively. ε is a random perturbation term. In addition, this article also uses return on equity (ROE) as an alternative to return on assets (ROA) to improve the reliability of the results.

Table 1. Variable description

Type	Name	Definition
Dependent Variable	ROA	Return on Assets (ROA) chosen as an indicator of company's Financial Performance (FP)
	ROE	Return on Equity (ROE) chosen as an indicator of company's Financial Performance (FP)
Independent Variable	DID	Primary explanatory variable representing the cross-multiplier of Treat and Post.
Control Variables	Size	Logarithm of total assets
	Shc	Shareholding concentration, expressed as the ratio of shareholdings of top ten shareholders
	Lev	Gearing ratio expressed as liabilities divided by total assets
	CMIR	Capital appreciation and preservation ratio expressed as current year's equity divided by previous year's equity
	ATO	Total assets turnover ratio expressed as operating income ratio divided by average total assets

3.2. Definition of variables

Control variables in this study encompass Size (measured by the logarithm of total assets), Shc (Shareholding concentration, denoted as the ratio of shareholdings held by the top ten shareholders), Lev (Gearing ratio represented by liabilities divided by total assets), CMIR (Capital appreciation and preservation ratio, calculated as the current year's equity divided by the previous year's

equity), and ATO (Total assets turnover ratio, calculated as the operating income ratio divided by the average total assets). The selection of these variables is grounded in prior scholarly research (J. Jiang *et al.* 2023; Jin & Lei 2023; Kwak 2019; Shi *et al.* 2023), with detailed descriptions provided in Table 1. The inclusion of these control variables enhances the robustness of the analysis and aligns with established methodologies in the field.Data Source

This study takes A-share companies listed in China between 2015 and 2020 as the research object. It adopts the double-difference method to explore the impact of EPT on the FP of heavily polluting enterprises. The detailed sample processing steps are as follows:(1) Firms in the financial industry and those replaced by ST, ST* and PT are excluded. (2) Firms with gearing ratios exceeding one were excluded. (3) After excluding the samples with severely insufficient data, the final observations of 10,239 samples were obtained. In order to minimize the interference of extreme values, the continuous variables are shrink-tailed through the operation in Stata. At the same time, the rest of the data are obtained from the CSMAR database.

4. Analysis of empirical results

4.1. Descriptive statistics

Table 2 presents the descriptive statistics of the main variables selected for this paper. According to the data in the table, the minimum and maximum values of ROA and ROE are -0.2733 and 0.1954, -0.6086 and 0.2979, respectively, and the variance of the variables exceeds the mean, indicating a high coefficient of dispersion, reflecting that the sample firms have significant individual differences in asset profitability. The variances of the other control variables are below the mean, indicating relatively small coefficients of dispersion, reflecting the high stability of the sample.

Table 2. Descriptive statistics of the main variables

Variable	Obs	Mean	SD	Min	Median	Max
ROA	10239	0.0434	0.0492	-0.2733	0.0407	0.1954
ROE	10239	0.0695	0.0838	-0.6086	0.0707	0.2979
DID	10239	0.1527	0.3597	0.0000	0.0000	1.0000
Size	10239	22.2664	1.1728	20.1641	22.1004	26.3599
Shc	10239	0.5904	0.1361	0.2555	0.5988	0.9045
Lev	10239	0.3981	0.1745	0.0644	0.3935	0.8361
CMIR	10239	1.1276	0.2493	0.6337	1.0667	2.9472
ATO	10239	0.6291	0.3382	0.1111	0.5618	2.4106

Table 3. Impact of EPT on the FP of heavily polluting enterprises

Variable	(1)	(2)	(3)	(4)
	ROA	ROA	ROE	ROE
DID	0.0114***	0.0056***	0.0188***	0.0095***
	(5.72)	(3.23)	(5.08)	(2.90)
Size		0.0300***		0.0584***
		(9.06)		(8.72)
Shc		0.0352***		0.0838***
		(3.31)		(3.91)
Lev		-0.1357***		-0.1571***
		(-13.49)		(-7.50)
CMIR		0.0173***		0.0365***
		(7.81)		(8.60)
ATO		0.0863***		0.1552***
		(14.87)		(14.00)
Cons_	0.0345***	-0.6924***	0.0564***	-1.3960***
	(16.13)	(-9.46)	(14.11)	(-9.52)
Year/Industry	Yes	Yes	Yes	Yes
Company	Yes	Yes	Yes	Yes
Observation	10239	10239	10239	10239
R^2	0.0287	0.2142	0.0217	0.1785

*Note: t-values in parentheses, *, **, and *** models pass 10%, 5%, and 1% significance tests, respectively, and the following table is the same as above*

4.2. Correlation analysis

Figure 1 shows the results of correlation analysis for each variable. As can be seen from the figure, the correlation coefficients of all variables are around 0.5, indicating that there is no serious multicollinearity problem.

4.3. Parallel trend test

The parallel trend assumption is the fundamental premise of the double difference model, which requires no significant difference between the experimental group (heavily polluting firms) and the control group (non-heavily

polluting firms) before the policy intervention to use the double difference model effectively. In this paper, we tested the impact of EPT on ROA and ROE by estimating the dynamic effect and the results are shown in **Figure 2**. It is evident from the figure that before the implementation of the EPT, ROA and ROE were not significantly different in the two groups (the confidence interval of regression coefficient contains 0), which is in line with the assumption of parallel trend; taking the period before the implementation of the policy as the baseline, in the current period of implementation of EPT, the experimental group is affected by the policy shock. Both are significantly increased compared with the control group (the confidence interval of the regression coefficient does not contain 0). In the long run, the treatment effect of EPT on the FP of heavy-polluting enterprises is positive. ROA and ROE are significantly different in the two groups, and it can be found in the figure that the experimental group, after its adjustment, is significantly higher than the control group, indicating that compared with the non-heavy polluting enterprises, heavy-polluting enterprises have significantly improved their FP. These results establish the "parallel trend hypothesis" and provide preliminary evidence that "EPT has a sustainable effect on the FP of heavily polluting enterprises."

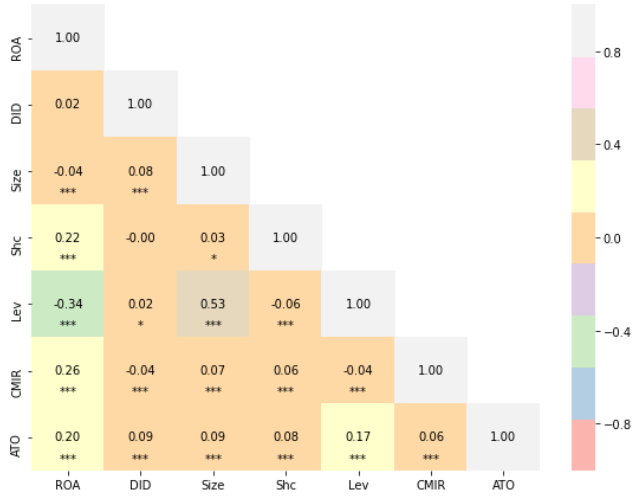


Figure 1. Correlation heat map

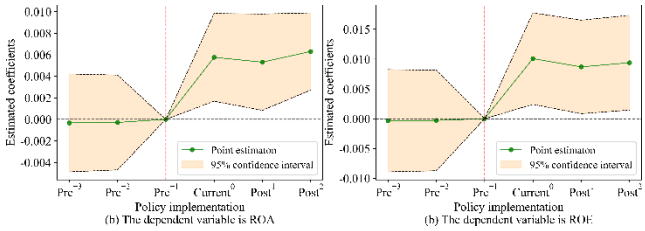


Figure 2. Parallel trend test

4.4. Benchmark regression

Next, this paper examines the impact of EPT on firms' FP. Based on the model (1), Table 3 reports the regression results of DID on ROA and ROE. All regression analyses control year, industry and firm fixed effects using robust standard errors.

Columns (1) and (2) of Table 3 show the effect of EPT on the profitability of assets of heavily polluting firms, and the regression coefficients of DID are both positive and significant, indicating that EPT is effective in enhancing the return on assets of heavily polluting firms. After controlling for other variables, the regression coefficient of DID is 0.0056 with a significance level of 1%, implying that EPT increases firms' return on assets by 0.056% on average. Columns (3) and (4) of Table 3 present the effect of EPT on the net asset profitability of heavily polluting enterprises, and the regression coefficient of DID is also positive and significant, which indicates that the EPT can effectively improve the net asset profitability of heavily polluting enterprises. These results validate the previous research hypothesis 1 that EPT positively affects the FP of heavy-polluting enterprises. In addition, the study reveals the effects of control variables on firms' FP; firm size, equity concentration, capital appreciation and preservation ratio, and total asset turnover ratio have significant positive effects on FP, while the gearing ratio has significant adverse effects on FP.

4.5. Placebo test

In order to test that other random factors do not cause the effect of an EPT on the FP of heavy polluters, this paper uses the placebo test to identify the contingency of the EPT treatment effect. Referring to the practice of relevant scholars (La Ferrara *et al.* 2012), according to the distribution of DID variables in the baseline regression, we randomly sample 500 times to create "pseudo-policy dummy variables" and regress the model (1) again to estimate and test the distribution of coefficients and P-values, and the results are shown in **Figure 3**. The effect of ROA and ROE on the ROA and ROE regression coefficients of "pseudo-policy dummy variables" are almost 0 on average, and much smaller than the benchmark regression coefficients. The distribution of the estimated coefficients is close to normal distribution, with P-values mainly greater than 0.10, which is not significant at the 10% level. This suggests that the impact of EPT on the FP of heavy polluters is not due to other random factors, and the conclusions obtained above are relatively robust.

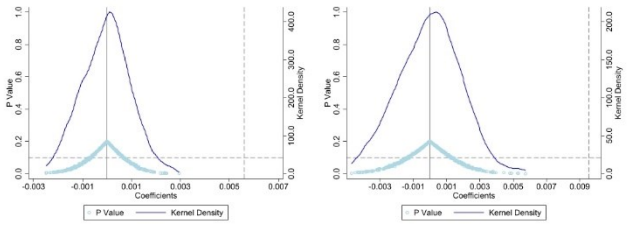


Figure 3. Placebo test

4.6. Heterogeneity analysis

The analysis above verifies how EPT affect the FP of heavily polluting firms. However, each enterprise's property rights characteristics and asset size are different, so will the policy responses of these enterprises to EPT be different? Next, the following section will delve into the differences between EPT and firms' FP from the perspectives of both firms' property rights characteristics and asset sizes.

Based on the different property rights characteristics, this paper divides enterprises into two categories: state-owned and non-state-owned. It utilizes the DID method to explore the impact of EPT on the FP of different types of

enterprises. Table 4 demonstrates the regression results; in the non-state-owned enterprise group, the effect of EPT on return on assets shows a significant positive correlation, while in the state-owned enterprise group, this effect is not significant. This implies that non-state-owned enterprises may have more substantial incentives to improve their FP under the EPT policy than state-owned enterprises. The reason for this may be that NSEs are more concerned with market and public feedback, more willing to reduce the burden of EPT, more able to adapt quickly to environmental changes, and more benefited from government support and incentives. Therefore, the positive incentive effect of EPT policy on non-state-owned enterprises may be more significant.

Table 4. Heterogeneity analysis based on the nature of enterprise property rights

Variable	(1) SOE	(2) NSOE	(3) SOE	(4) NSOE
	ROA	ROA	ROE	ROE
DID	0.0028	0.0074***	0.0039	0.0122***
	(1.19)	(3.26)	(0.78)	(3.01)
Size	0.0275***	0.0339***	0.0454***	0.0676***
	(5.07)	(8.19)	(3.63)	(8.44)
Shc	-0.0430**	0.0655***	-0.0780*	0.1522***
	(-2.12)	(4.89)	(-1.69)	(5.78)
Lev	-0.1442***	-0.1387***	-0.1894***	-0.1552***
	(-7.60)	(-11.54)	(-4.68)	(-6.36)
CMIR	0.0218***	0.0137***	0.0554***	0.0266***
	(5.26)	(5.22)	(5.52)	(5.68)
ATO	0.0523***	0.1080***	0.1043***	0.1853***
	(7.25)	(12.98)	(7.09)	(12.32)
Cons_	-0.5554***	-0.7936***	-0.9729***	-1.6266***
	(-4.87)	(-8.60)	(-3.71)	(-9.17)
Year/Industry	Yes	Yes	Yes	Yes
Company	Yes	Yes	Yes	Yes
Observation	2939	7300	2939	7300
R^2	0.2124	0.2315	0.1699	0.1951

Note: Same as above table

Table 5. Heterogeneity analysis based on asset size

Variable	(1) Large scale	(2) Small scale	(3) Large scale	(4) Small scale
	ROA	ROA	ROE	ROE
DID	0.0069***	0.0036	0.0118***	0.0052
	(3.13)	(1.24)	(2.62)	(1.00)
Size	0.0367***	0.0409***	0.0761***	0.0768***
	(7.31)	(6.92)	(6.78)	(6.36)
Shc	0.0398***	0.0574***	0.0937***	0.1256***
	(2.78)	(3.08)	(3.03)	(3.47)
Lev	-0.1650***	-0.1388***	-0.2073***	-0.1759***
	(-11.55)	(-8.98)	(-6.72)	(-5.49)
CMIR	0.0148***	0.0183***	0.0368***	0.0331***
	(5.48)	(4.73)	(6.30)	(4.71)
ATO	0.0694***	0.1165***	0.1422***	0.1887***
	(9.70)	(12.20)	(9.36)	(11.30)
Cons_	-0.8101***	-0.9257***	-1.7674***	-1.7688***
	(-7.06)	(-7.42)	(-6.89)	(-6.93)
Year/Industry	Yes	Yes	Yes	Yes
Company	Yes	Yes	Yes	Yes
Observation	4987	5252	4987	5252
R^2	0.2492	0.2306	0.204	0.1932

Note: Same table as above

In order to explore the impact of EPT on the FP of enterprises of different sizes, this paper divides the sample into two groups, large and small, according to the average value of enterprise size. **Table 5** demonstrates the results of the regression analysis. From the table, in the large-scale enterprise group, the effect of EPT on return on assets shows a significant positive correlation. In contrast, in the small-scale enterprise group, this effect is not significant. The return on net assets results are similar to the return on assets for both firms. Under China's EPT policy, large-scale firms are more likely to be more strongly affected than small-scale firms. The reasons for this may be that large-scale firms have higher emissions and face higher EPT burdens, and therefore have more incentives to invest in

environmental protection measures to reduce pollutant emissions; large-scale firms have more public attention and are more likely to cause social pressure on environmental issues, and therefore are more inclined to take proactive environmental protection measures to maintain their corporate image and market position; and large-scale firms are better resourced and financed, and are able to more easily afford the costs of environmental improvements. resources and capital, and can more easily bear the costs required for environmental protection improvements, and are more capable of investing in technological upgrades, equipment renewal and environmental protection facility construction; large-scale enterprises are subject to greater government regulatory pressure, and may be in the focus of government regulation, and therefore may be subject to stricter enforcement of EPT policies.

5. Conclusion

This study underscores the enduring positive impact of China's environmental protection tax (EPT) on the long-term financial performance (FP) of heavily polluting firms. From a global standpoint, these findings contribute to the ongoing international discourse on the efficacy of environmental taxation in promoting sustainable business practices. To further propel green development, it is recommended that the Chinese government enhance the EPT policy, particularly by augmenting financial support for non-state-owned and large-scale enterprises. Additionally, the establishment of a robust green financial mechanism and an international regulatory framework becomes imperative. Such measures not only direct funds towards environmental protection but also ensure the effective implementation of policies incentivizing environmentally responsible behavior. This broader perspective accentuates the potential global ramifications of China's EPT policy enhancements, advocating for the adoption of similar measures in other nations to collectively address environmental challenges.

6. Research limitations

Despite the valuable insights provided, this study has limitations that warrant consideration. Firstly, the analysis focuses exclusively on publicly listed heavily polluting firms, potentially limiting the generalizability of findings to non-listed entities. Additionally, the study's reliance on financial performance metrics may not fully capture the nuanced environmental impact of the implemented environmental protection tax (EPT) policy. Furthermore, the research predominantly relies on quantitative data, leaving potential qualitative dimensions unexplored. Future research could overcome these limitations by incorporating a more diverse sample and employing a mixed-methods approach to offer a comprehensive understanding of the multifaceted effects of EPT policies on various enterprises.

References

Gu Y. and Wang S.H. (2023). Corporate environmental information disclosure and tax avoidance: Evidence from China, *Heliyon*, **9**

Guan H. J., Zhang Y. X. and Zhao A. W. (2023). Environmental taxes, enterprise innovation, and environmental total factor productivity-effect test based on Porter's hypothesis, *Environmental Science and Pollution Research*, **30**, 99885–99899.

Guo B. N., Feng W. Z., Yu Y. S., Zhang H. and Hu F. (2023). Can environmental tax improve the environmental investment? Evidence from a quasi-natural experiment in China, *Environmental Science and Pollution Research*

Hu J., Fang Q. and Wu H.Y. (2023). Environmental tax and highly polluting firms' green transformation: Evidence from green mergers and acquisitions, *Energy Economics*, **127**

Hu X. R., Wu H. H., Ni W. L., Wang Q. W., Zhou D.Q. and Liu J.F. (2023). Quantifying the dynamical interactions between carbon pricing and environmental protection tax in China, *Energy Economics*, **126**

Huang J. Q. and Li Y. F. (2023). China's environmental "fee-to-tax" and foreign direct investment-An empirical study based on intensity difference-in-differences, *Frontiers in Environmental Science*, **11**

Jiang X., Li G.L. and Fan X.X. (2023). Environmental Protection Fee-to-Tax and Corporate Environmental Social Responsibility: A Test Based on Corporate Life Cycle Theory, *Sustainability*, **15**

Kong L.Q., Wang S.M. and Xu K. (2023). The impact of environmental protection tax reform on total factor energy efficiency, *Clean Technologies and Environmental Policy*

La Ferrara E., Chong A. and Duryea S. (2012). Soap Operas and Fertility: Evidence from Brazil, *American Economic Journal-Applied Economics*, **04**, 1–31.

Lei Y.T., Zhang X., Yao C.Z. and Peng W.X. (2023). Redesigning carbon emissions reduction policies for China's manufacturing industry: a dynamic stochastic general equilibrium approach, *Frontiers in Energy Research*, **11**

Li K.M., Wen J.H., Jiang T.J., Fan X.M. and Huang L.X. (2023). How tax competition affects China's environmental pollution?: A spatial econometric analysis, *Environment Development and Sustainability*

Lin Y.F., Liao L.X., Yu C.X. and Yang Q.S. (2023). Re-examining the governance effect of China's environmental protection tax, *Environmental Science and Pollution Research*, **30**, 62325–62340.

Liu C. Y. (2023). Can water resource tax reform improve the environmental performance of enterprises? evidence from China's high water-consuming enterprises, *Frontiers in Environmental Science*, **11**

Ma X. H. and Cui Y. M. (2023). Can the China's environmental tax reform improve the enterprises sustainable environmental protection practice?-from the perspective of ISO14001 certification, *Environmental Science and Pollution Research*, **30**, 102604–102623.

Rao M. Y., Vasa L., Xu Y. D. and Chen P. H. (2023). Spatial and Heterogeneity Analysis of Environmental Taxes' Impact on China's Green Economy Development: A Sustainable Development Perspective, *Sustainability*, **15**

Su Y.T., Zhu X.B., Deng Y.Y., Chen M. and Piao Z.X. (2023). Does the greening of the tax system promote the green transformation of China's heavily polluting enterprises?, *Environmental Science and Pollution Research*, **30**, 54927–54944.

Sun X.K. and Zhang C.Y. (2023). Environmental protection tax and total factor productivity-Evidence from Chinese listed companies, *Frontiers in Environmental Science*, **10**

Wei Y.H.D. and Liefner I. (2012). Globalization, industrial restructuring, and regional development in China, *Applied Geography*, **32**, 102–105.

Xu Y., Wen S. and Tao C.Q. (2023). Impact of environmental tax on pollution control: A sustainable development perspective, *Economic Analysis and Policy*, **79**, 89–106.

Yan T. M., Zhang T. and Zhu Z.G. (2023). The Environmental Tax Scheme in China's Large-Scale Pig Farming: Balancing Economic Burden and Responsibility, *Agriculture-Basel*, **13**

Yang R. and Peng A. (2021). Environmental regulation, technological innovation and performance of heavily polluting firms, *Journal of East China Normal University (Philosophy and Social Science Edition)*, **01**, 129–141.

Zeng M., Zhang K., Xu D.D., Ma H.J. and Deng X. (2023). The complex impacts of economic growth pressure on carbon emission intensity: an empirical evidence from city data in China, *Environmental Science and Pollution Research*, **30**, 109135–109144.

Zhang M. and Rasiah R. (2015). Globalization, industrialization and labour markets in China, *Journal of the Asia Pacific Economy*, **20**, 14–41.

Zhao L. X., Tang Y. P. and Liu Y. (2023). How Does Environmental Tax Influence the Scale and Efficiency of Green Investment among China's Heavily Polluting Enterprises?, *Sustainability*, **15**

Zheng Q., Li J.Y. and Duan X.L. (2023). The Impact of Environmental Tax and R&D Tax Incentives on Green Innovation, *Sustainability*, **15**

Zhou Y.X. and Yang,W.X. (2023). Differentiated environmental taxes and high-quality economic development in China: theory and evidence, *Environmental Science and Pollution Research.*